



CONTROL# 09/803067 (AMENDED)

SPECIFICATION

TITLE: PROCESS FOR TREATING JUICES WITH ULTRAVIOLET ACTIVATED OXYGEN

CROSS REFERENCE: NO RELATED APPLICATIONS USING ULTRAVIOLET
ACTIVATED OXYGEN BUBBLED THROUGH JUICES.

FEDERAL SPONSOR, ETC. NOT APPLICABLE

MICROFICHE: NOT APPLICABLE

BACKGROUND OF INVENTION

TECHNICAL FIELD:

THIS INVENTION RELATES TO A METHOD OF PATHOGEN DESTRUCTION
IN A LIQUID SUBSTANCE WITHOUT THE USE OF A PASTEURIZATION
PROCESS.

IT IS WELL KNOWN THAT THE USE OF ULTRAVIOLET ACTIVATED
OXYGEN DESTROYS PATHOGENS ON CONTACT. AND DOES NOT
AFFECT THE ENZYMES

TABLE 1 IS A LIST OF COMPONENTS IN ACTIVATED OXYGEN.
ASSUMING AMBIENT AIR HAS 21% OXYGEN CONTENT, FOLLOWING
ARE THE TYPES OF GASSES FORMED BY THE ULTRAVIOLET LAMP
(185 NANOMETER-254 NANOMETER) FROM THE 21% OXYGEN IN THE AIR.

TABLE 1

<u>HYDROXY RADICAL</u>	<u>2%</u>
<u>ATOMIC OXYGEN</u>	<u>0.5%</u>
<u>HYDROGEN PEROXIDE</u>	<u>6%</u>
<u>HYDROPEROXY RADICAL</u>	<u>2%</u>
<u>HIGHER PEROXIDES</u>	<u>7%</u>
<u>OZONE</u>	<u>2%</u>
<u>UNKNOWN</u>	<u>1.5%</u>

THESE ARE ALL EXCELLENT OXIDIZERS, AND AS A GROUP THEY TEST
10% TO 20% MORE ACTIVE THAN THE EPA TEST FOR STANDARD OZONE.

BACKGROUND ART:

IN U.S. 21CFR Ch. 1 (4-1-98) 184.1563 OZONE IS FDA APPROVED TO STERILIZE
BOTTLED WATER.

ALL OTHER RELATED ART FOUND RELATES TO WATER PURIFICATION
WITH CORONA DISCHARGE PRODUCED OZONE OR THE USE OF AN
ULTRAVIOLET BIOCIDAL LAMP (254 NANOMETER) WHERE THE LIQUID IS
EXPOSED TO THE 254 NANOMETER FREQUENCY.
IT IS NOT KNOWN IF THIS HAS BEEN APPROVED BY THE FDA FOR USE IN FOOD.

ON JUNE 26, 2001 THE FDA APPROVED THE USE OF OZONE IN GASEOUS
AND AQUEOUS PHASES AS AN ANTIMICROBIAL AGENT IN FOOD.
(FEDERAL REGISTER VOL. 66 NO 123 PAGE 33829).

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BRIEF SUMMARY OF INVENTION

THE PRESENT INVENTION PROVIDES A SPECIFIC METHOD TO DESTROY PATHOGENS IN A LIQUID AT AMBIENT TEMPERATURE AND VARYING TURBIDITY (AN EXAMPLE IS APPLE CIDER AND PULPY ORANGE JUICE).

THE ACTIVATED OXYGEN COMPONENTS (TABLE 1) BEING DISPENSED AND MIXED THROUGH THE LIQUID CONTACTS AND DESTROYS THE PATHOGENS.

THE METHOD OF DESTRUCTION IS AS FOLLOWS:

1. OXYGEN ATOMS IN PRESENCE COMBINE TO FORM OZONE (O₃) WHICH HAS A HALF LIFE OF 30 MINUTES.
2. WHEN OZONE CONTACTS A PATHOGEN, THE THIRD OXYGEN MOLECULE ATOM DETACHES ITSELF FROM THE OZONE MOLECULE AND ATTACHES TO THE PATHOGEN TO OXIDIZE IT.
3. IN THE PATHOGEN THIS OXIDATION RESULTS IN A CHANGE IN THE CELL PERMEABILITY.
4. IN SIMPLE TERMS, THE UNSTABLE ELECTRONS OF OZONE OXIDIZES, CREATING HOLES THROUGH THE PATHOGEN MEMBRANE.

NOTE: THE ACTIVATED OXYGEN DOES NOT AFFECT THE ENZYMES.

BRIEF DESCRIPTION OF VIEWS OF DRAWINGS

FIGURE 1: OVERVIEW OF ACTIVATED OXYGEN EQUIPMENT, PAGE 7

STATEMENT FOR FIGURE 1: PAGES 4, 5, 6

FIGURE 2: INTERNAL VIEW OF ACTIVATED OXYGEN REACTOR

WITH STATEMENT PAGE 8

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DETAILED DESCRIPTION OF THE INVENTION

The purpose of the invention is to introduce a method for achieving a 5-log reduction of the pathogens in juices, without causing any damage to the enzymes.

The invention (see illustration #1) consists of an oil less compressor (A) with a 1-3 micron filter (A-1) to supply air for the inventions. The air is pumped down a conduit of CPVC or stainless steel to a regulator assembly (B) to regulate a constant pressure within the invention.

The Regulator consists of an oil filter (B-1) and a water filter (B-2). These filters are used to remove any tramp oil or water that would be picked up by the ambient air. Thereby keeping the air clean.

The clean air then passes onto a safety pressure relief valve (C). The purpose of the pressure relief valve is to prevent any damage to the system should the regulator fail. The pressure relief valve is of the kind that can be adjusted (5 to 75 pounds) depending upon the size of the system and the required amount of air.

The air is exposed to a visual gauge with a protector (D) for the purpose of a visual check of the air pressure within the system. The air now passes through a pressure flow sensor (E). The sensor sends a 4 and 20 signal to the controller in the control panel to regulate the power to the system and to activate the timer and strip chart. If the controller does not receive a signal for 1 minute, the controller will shut down the system.

The air is now forced through a Mazzei injector (F) where high humid air is inducted into the air stream before entering into the generator (h1-H10) in cabinet (H).

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The air being pumped into the generators (h1-H10) passes through in a serpentine manner as to expose the air and humidity for the longest time possible, exposing the highly humid air to the U.V. light and catalysis. By having the air follow a serpentine path with in the generators (see illustration #2) Baffles placed at 9 inches intervals on ½" 316 Stainless steel all thread rods with U.V. lights (1-6 each of H), placed with in the generator held in place by compression seal fittings (G). The humid air is exposed to the lights and to the catalysis impregnated in the liner of the generators (I-Trade secret).

The U.V. light (H) being exposed to the air and humidity start to convert the air and humidity in to other species, such as ozone, hydroxyls, peroxides, hyper-proxy's and atomic oxygen. The species are then pumped to a sparging system (K) (see: illustration #3).

The sparging system is so constructed as to allow the gaseous species to be injected into the juice in a manner that maximum contact between the gaseous species and the juice maybe kept from the time the juice enters the serpentine tank (I) till it is removed. This contact time between the gaseous species and juice will achieve a five-log reduction in the pathogens, leaving the enzymes in tact.

All of the equipment use in the system of invention maybe purchase through Grainger, McMaster-Carr, Atlantic Ultra Violet, American Ultra Violet, Ryan Herco or Porex, with the exception of the generators and catalytic liner.

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OVERVIEW OF THE A.O. EQUIPMENT

The system consists of the following equipment.

A Being a compressor for the purposes of introducing the ambient air into the system. A-1, being a hepa filter used to filter the air entering the system and protects the internal components.

B Being a combination regulator oil separator and water coalescer designed to remove any water, oil and regulates the air at 10 pound to 42 pound entering the A.O. system. B-1, being a coalescent oil filter to remove any tramp oil. B-2, being a filter designed to remove particulates water from the air stream. B-3 being a pressure regulator designed to hold the air stream at a consistent preset pressure from 5 pound to 150 pound. This component is a very important part of the system.

C Being a safety relief valve. This valve is preset for each system to relieve the pressure if it exceeds the system pressure allowance.

D Being a system pressure gauge for visual recognition of the pressure in the system.

E Being an electronic flow meter that relays a 4 and 20 signal to start a strip chart and hour meter in the control panel.

F Being a Mazzei injector type injector for the induction of a controlled amount of 100 percent humid air. The air being taking from the exhaust filter, J-1 off the J-2 coalesce side of the filter through hose f-1 through flow control valve G to the Mazzei injector valve, which feeds the air through the generators in unit H. To create the activated oxygen and other species of oxidants.

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G Being a flow control valve to regulate the injection of humidity into the Mazzei injectors.

H Being a Polypro cabinet housing the A.O. generators. H-1 through H-4. The cabinet is constructed of ½ inch polypro with unistrut braces, which also are the mounting brackets for the generators and ballast.

H1 - H4 H-1 through H-4, Being A.O. generators constructed of tubing of stainless steel with liners, baffles and ultra violent lights or of plastic tubing with liners, baffles and ultra violent lights. The liners and baffles being coated or impeded with catalysts that we hold as trade secret. The air being pressurized through the generator where the air and humidity are exposed to the ultra violent lights and catalyst to create O_3 hyper peroxides and hydroxyls which are then pressured through the pipes to the serpentine tank (I) where the gas is injected into the fluid through sparging tubes installed in each clarifier.

I Being a tank divided into chambers so designed as to cause the fluid to pass through in a serpentine manner. The amount of chambers and size of the tank are determined by the g.p.m. and the time needed for a 5 log kill of the pathogens. The fluid would enter at one end and pass through each chamber in a serpentine manner at the same time A.O. would be injected through sparging tubes at the bottom of each chamber saturating the fluid with A.O. for given time to expose the fluid long enough for the pathogens to be destroyed.

J Being an exhaust filter for the systems consisting of a polypro cabinet with chambers for coalescing out particulate water and carbon to contain any odors or trapped gases. Allowing a percentage of the exhaust to be recycled back into the system as the introduction of humidity.

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K Being a sparging system consisting of piping and flow control valves for each sparger in each chamber, to regulate the flow of A.O. The sparging system is so constructed as to allow each sparger to be regulated and the C.F.M. to be controlled and monitor keeping the sparger exhausting into the fluid at 5 micron to 30 micron bubbles. The size of the bubbles is controlled by the p.s.i. of the flow of A.O.

L Control panel being constructed of polypro to house the strip chart and hour meter, fuses, and power switches.

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CLAIMS

WE CLAIM:

1. A METHOD OF PATHOGEN REMAVAL FOM JUICES COMPRISING THE STEPS OF:
 - A. CREATING ACTIVATED OXYGEN GAS BY PASSING AMBIENT AIR OVER AN ULTRAVIOLET LAMP (185 NANOMETER FREQUENCY).
 - B. INJECTING THE ACTIVATED OXYGEN GAS INTO THE JUICE CONTAINER USING POROUS SPARGING TUBES (BUBBLE CREATING) TO CREATE 20 TO 60 MICRON ACTIVATED OXYGEN BUBBLES.
 - C. TO BUBBLE THE ACTIVATED OXYGEN GAS FOR A SPECIFIC AMOUNT OF TIME (TIME WILL VARY WITH DIFFERENT JUICES).
 - D. THE EXPOSURE TO ACTIVATED OXYGEN FOR THE SPECIFIC DESIGNED TIME WILL DESTROY PATHOGENS, AND NOT AFFECT ENZYMES.
2. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS APPLE CIDER
3. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS ORANGE
4. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS TANGERINE
5. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS CRANBERRY
6. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS LIME
7. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS GRAPEFRUIT
8. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS CHERRY
9. THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS GRAPE
- 10 THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS APRICOT
- 11 THE PROCESS FOR CLAIM1, WHEREIN THE JUICE IS STRAWBERRY
- 12 THE PROCESS FOR CLAIM1, WHEREIN THE JUICE IS NECTARINE
- 13 THE PROCESS OFR CLAIM 1, WHEREIN THE JUICE IS PEACH
- 14 THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PEACH NECTAR
- 15 THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS RASPBERRY
- 16THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS LEMON
- 17THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PEAR
- 18THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PINEAPPLE
- 19THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS BLACKBERRY
- 20THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS BLUEBERRY
- 21THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PRUNE
- 22THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS MANGO
- 23THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PAPAYA
- 24THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS GUAVA
- 25THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS BOYSENBERRY
- 26THE PROCESS FOR CLAIM 1, WHEREIN THE JUICE IS PLUM
- 27THE PROCESS FOR CLAIM 1, FOR ANY MIXTURES OF THE ABOVE
- 28THE PROCESS FOR CLAIM 1, WILL NOT DESTROY THE ENZYMES AS DOES ALL PASTEURIZATION SYSTEMS.

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ABSTRACT

A METHOD FOR ACHIEVING A 5 LOG REDUCTION OF PATHOGENS (99.99%)
IN JUICES USING A ULTRA VIOLET GENERATED ACTIVATED OXYGEN
GAS. THIS PROCESS WAS APPROVED BY THE FDA IN JUNE 26, 2001
(REFERENCE : FEDERAL REGISTER. VOL. 66, NO 123 PAGE 33829).
THE ULTRA VIOLET LAMP CREATES A SPECIFIC WAVE LENGTH
(185 NANO METER) WHICH DESTROYS (BY OXIDATION) PATHOGENS
ON CONTACT. THE ACTIVATED OXYGEN GAS IS INTRODUCED INTO
A CONTAINER HOLDING THE JUICE BY USING A SPARGING SYSTEM
WHICH DELIVERS THE ACTIVATED OXYGEN GAS IN 20 TO 60 MICRON
BUBBLES IN THE CONTAINER (SATURATING THE JUICE) WHICH
ALLOWS ACTIVATED OXYGEN GAS CONTACT WITH THE PATHOGENS,
THUS ACHIEVING THE FDA REQUIRED 5 LOG REDUCTION IN PATHOGENS.
THE ACTIVATED OXYGEN SYSTEM AND SPARGING SYSTEM ARE
ALSO DISCLOSED.
THIS METHOD DOES NOT DESTROY THE ENZYMES IN THE LIQUID AS ALL
PASTEURIZATION SYSTEMS DO (ANY TEMPERATURE OVER 123 DEGREE F
DESTROYS ALL ENZYMES).

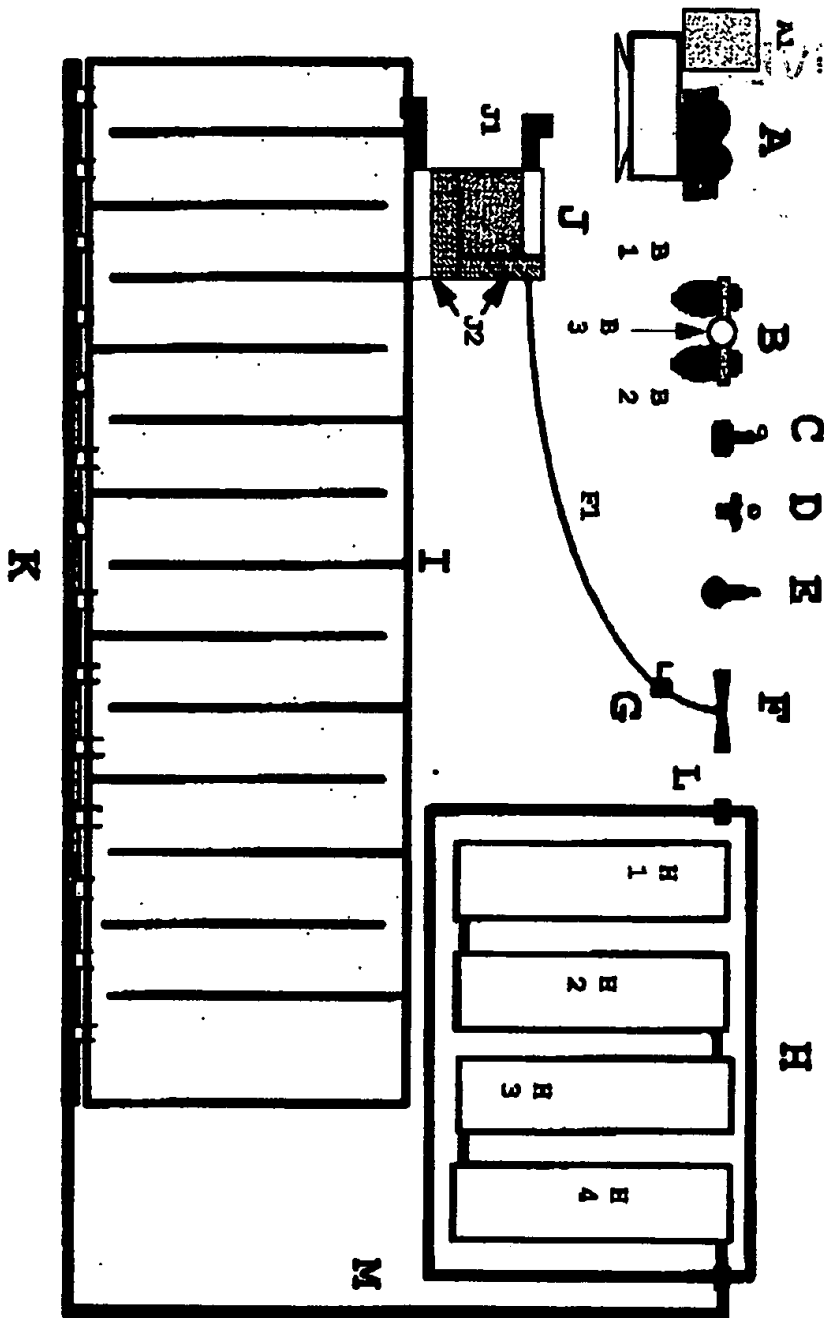
28 CLAIMS

3 DRAWING SHEETS

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ILLUSTRATION # 1



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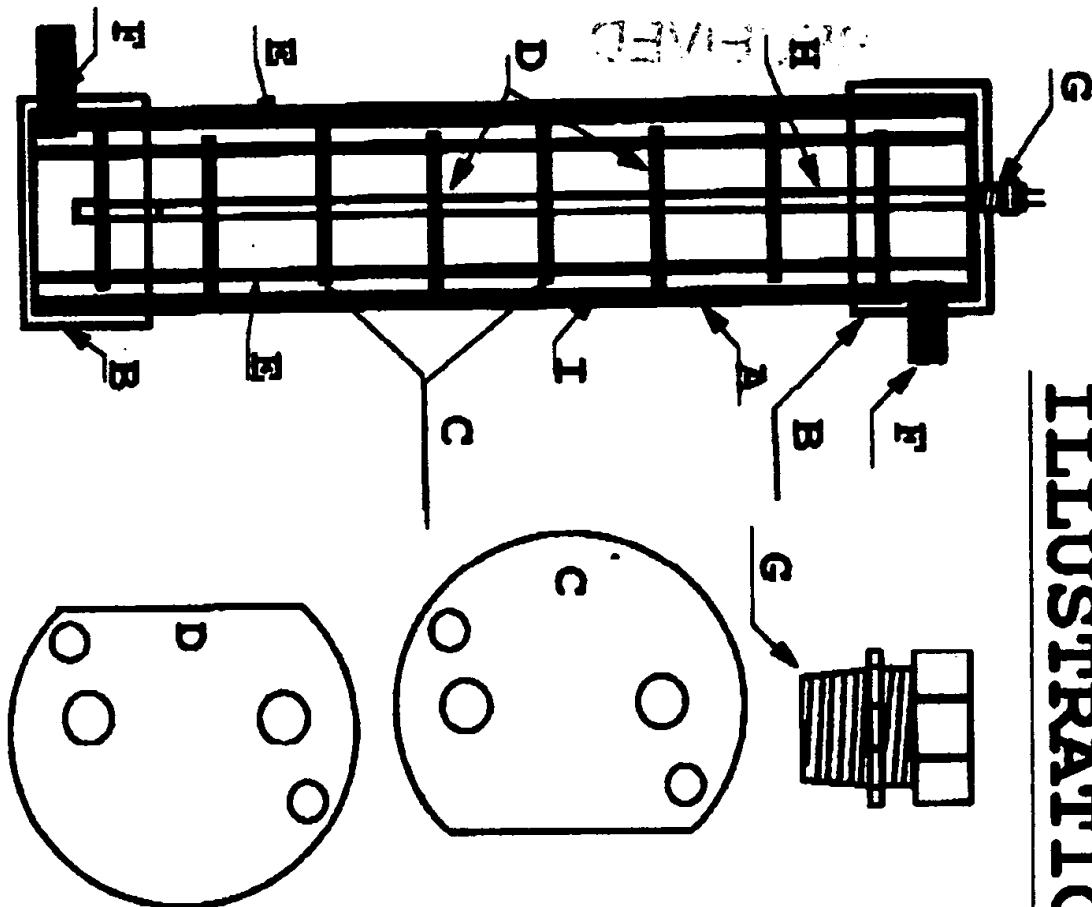


ILLUSTRATION # 2

- | | |
|------------------------------|---|
| A.- OUTER SHELL | 1 |
| B.- CAP HEAVY DUTY | 2 |
| C.- BAFFLE 3/8" PVC | 4 |
| D.- BAFFLE 3/8" PVC | 4 |
| E.- 1/2" 316 S.S. ALLTHREAD | 2 |
| F.- AIR CONNECTIONS | 2 |
| G.- COMPRESSION SEAL FITTING | 2 |
| H.- ULTRAVIOLET LIGHT 185 NM | 2 |
| I.- LINER (TRADE SECRET) | 1 |

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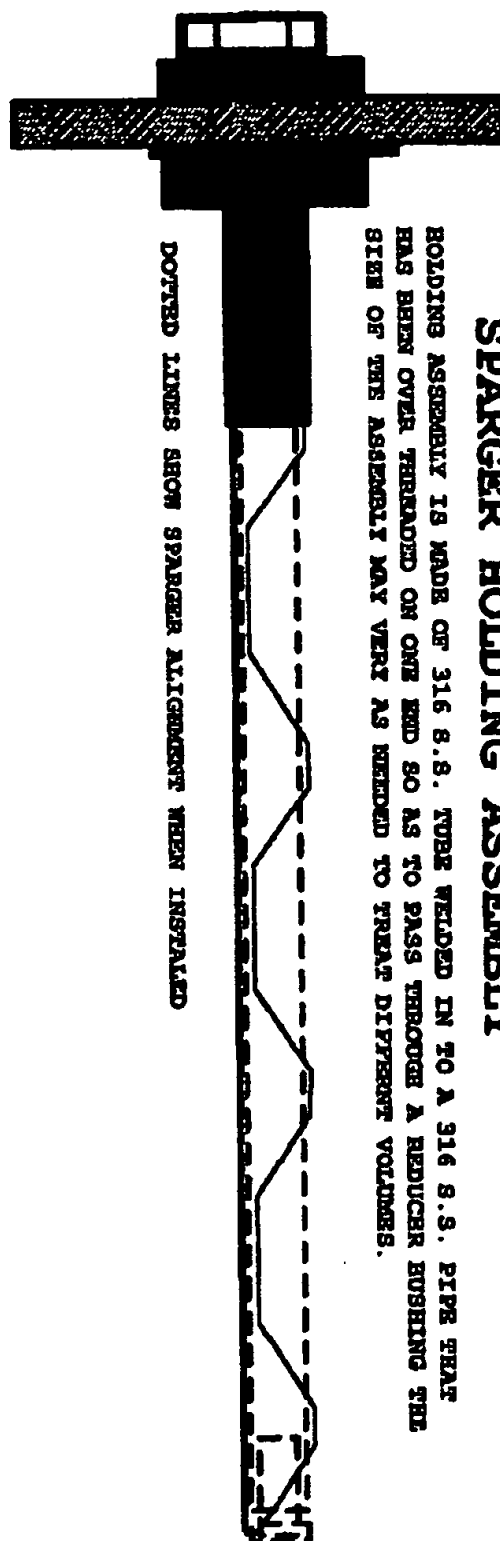


ILLUSTRATION # 3

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SPARGER HOLDING ASSEMBLY

HOLDING ASSEMBLY IS MADE OF 316 S.S. TUBE WELDED IN TO A 316 S.S. PIPE THAT HAS BEEN OVER THREADED ON ONE END SO AS TO PASS THROUGH A REDUCER BUSHING THE SIZE OF THE ASSEMBLY MAY VARY AS NEEDED TO TREAT DIFFERENT VOLUMES.



DOTTED LINES SHOW SPARGER ALIGNMENT WHEN INSTALLED



SPARGER MAY BE ANY SIZE FROM 1/2" TO 4.0" PIPE SIZE POLYPRO 20 MICRON POREX TUBE MOUNTED IN A CPVC REDUCER BUSHING 2 X 2 SIZE TO FIT THE HOLDING ASSEMBLY. SPARGER MUST HAVE APLOS IN THE OPEN END OF 316 S.S. THE HOLDING ASSEMBLY IS MOUNTED THROUGH THE TANK WALL BY THE USE OF BOLTHREAD FITTINGS.

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